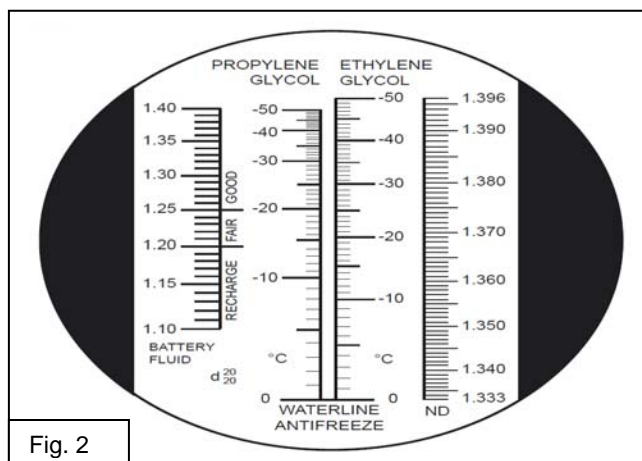
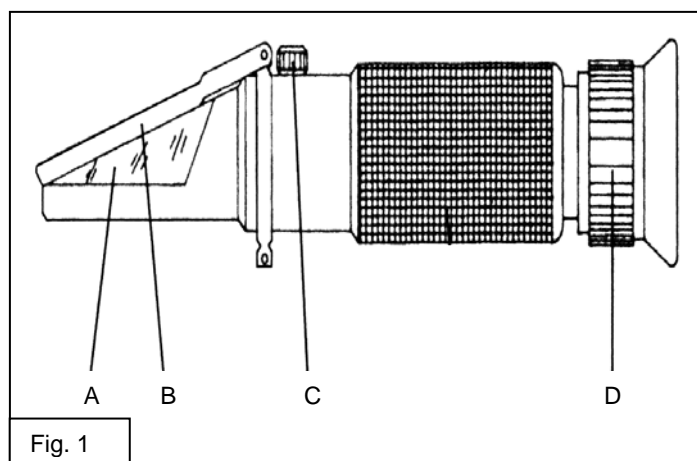


Refractometer

Instructions for Use



Freezing point measurement of TYFOCOR® and TYFOCOR® L / water mixtures



General

The refractometer (Fig. 1) allows rapid and accurate check of freezing points of coolants and heat-transfer media based on ethylene glycol and propylene glycol by reading from the respective scales (Fig. 2). The refractive index (ND) of the sample fluid is simultaneously displayed. Battery acid can also be checked with the aid of this measuring device.

Calibration procedure

1. Open the illuminating plate (B), apply 1-2 drops of distilled water onto the prism surface (A) by using the pipette contained in the test set and press the plate onto the prism surface.
2. Turn the pointy end of the refractometer to the light and look into the eyepiece (D). Focus the scale to your vision by rotating the eyepiece until the scale is clear and easy to read. Rotate the adjusting screw (C) with the screwdriver included in the test set so that the light / dark boundary line evens up with the zero line (Fig. 2, WATERLINE). After the calibration procedure, dry the surfaces properly.

Measurement procedure

1. Open the illuminating plate, apply 1-2 drops of test fluid onto the prism surface, close illuminating plate.

2. Turn the pointy end of the refractometer to the light, rotate the eyepiece until the light / dark boundary line becomes visible. The line indicates the **freezing point** of TYFOCOR® / water mixtures (reading from the ethylene glycol scale), and the **frost protection** (reading from the propylene glycol scale) in case of TYFOCOR® L / water mixtures. These terms are explained on page 2.

Instructions for measuring

1. Place a few drops of a sample liquid on prism surface, make sure that it is entirely covered. The light / dark boundary line cannot be seen clearly if too much or too little sample liquid is present. After measuring, the sample liquid must be removed from the prism surface by carefully rinsing it with water and drying with a clean cloth. Incorrect reading can result from a poorly cleaned and dried prism surface.
2. If the refractometer is contaminated by oil, grease or similar matter, an accurate measurement is not possible, since the fluid will be repelled from the prism surface. In this case clean the surface with a spiritus soaked cloth and dry it properly afterwards.
3. Do not damage the prism surface. Do not clean the refractometer under running water. It is splash-proof, but not waterproof.



TYFOROP Chemie GmbH

Anton-Rée-Weg 7 D-20537 Hamburg Tel./Fax: +49 (0)40 20 94 97-0/20 e-mail: info@tyfo.de

04/12, p.1

Refractometer

Instructions for Use



Freezing point measurement of TYFOCOR[®] and TYFOCOR[®] L / water mixtures

Antifreeze effect of TYFOCOR[®] and TYFOCOR[®] L / water mixtures

TYFOCOR[®] (based on ethylene glycol) and TYFOCOR[®] L (based on propylene glycol) lower the freezing point of water down to -50 °C, depending on their concentration.

The **freezing point**, colloquially called “antifreeze”, is a measure for the freezing-point depression of antifreeze fluids. When a given TYFOCOR[®] or TYFOCOR[®] L / water mixture will be cooled down, the freezing point is the temperature at which initial ice crystals begin to form. The resulting ice slurry does not possess any expansive force. Further reduction in temperature causes further thickening of the ice slurry until it solidifies at the **pour point**. Only below this temperature, there is danger of bursting for the installation. The arithmetic mean from freezing point and pour point is referred to as **frost protection**.

The following table displays the freezing points, frost protection and pour points of TYFOCOR[®] and TYFOCOR[®] L / water mixtures as a function of the concentration:

TYFOCOR[®] (reading from ethylene glycol scale)

TYFOCOR[®] L (reading from propylene glycol scale)

% vol.	Freezing pt. Reading	Frost protection	Pour point	% vol.	Freezing pt.	Frost protection Reading	Pour point
20	- 9.0 °C	- 11.0 °C	- 13.0 °C	25	- 10.7 °C	- 11.5 °C	- 12.3 °C
25	- 12.3 °C	- 14.8 °C	- 17.3 °C	30	- 14.0 °C	- 15.0 °C	- 16.0 °C
30	- 16.1 °C	- 19.1 °C	- 22.0 °C	35	- 17.6 °C	- 19.0 °C	- 20.4 °C
35	- 20.4 °C	- 23.7 °C	- 26.9 °C	40	- 21.5 °C	- 23.7 °C	- 26.0 °C
40	- 25.2 °C	- 28.6 °C	- 32.0 °C	45	- 26.0 °C	- 29.6 °C	- 33.3 °C
45	- 30.8 °C	- 33.4 °C	- 37.2 °C	50	- 32.4 °C	- 38.2 °C	- 44.0 °C
50	- 37.6 °C	- 40.7 °C	- 45.2 °C	55	- 40.4 °C	- 48.5 °C	< -50 °C
55	- 45.4 °C	< - 50 °C	< - 50 °C	60	- 48.4 °C	< -50 °C	< -50 °C

In order to maintain effective protection from frost and corrosion, a concentration of at least 20 volume percent of TYFOCOR[®] Concentrate must be applied when mixed with water.

In case of TYFOCOR[®] L a minimum concentration of 25 volume percent must be applied. When used for Solar Thermal Systems, however, the concentration must be at least 40 volume percent.



TYFOROP Chemie GmbH

Anton-Rée-Weg 7 D-20537 Hamburg Tel./Fax: +49 (0)40 20 94 97-0/20 e-mail: info@tyfo.de 04/12, p.2